

# Video in Logger *Pro*

Video can be used in Logger *Pro* in a number of ways.

- You can analyze a video frame by frame to track the motion of one or more objects. This is called *video analysis* and is most often used in physics.
- You can view a video that is synchronized to sensor data. This enhanced record of an experiment can be replayed at varying speeds, and the graph Examine feature will snap the video to the corresponding frame as the mouse is moved over a graph.
- Or, you can do both synchronized video with sensor data coupled with video analysis.

The videos you use can either be existing files, such as those supplied with Logger *Pro*, or you can capture the videos yourself using a variety of cameras. Logger *Pro* includes video capture features to make capture simple.

This introduction to video in Logger *Pro* first discusses video analysis, then the process of viewing and synchronizing video to sensor data, and finally the process of video capture.

---

## Video Analysis

You can use the Video Analysis tool to create a graphical representation of the motion you see in a movie or picture<sup>1</sup>. This is ideal for mathematically analyzing real-world events.

After you insert a movie, you will be able to open the Video Analysis toolbar. The motion that you trace directly on the movie will be displayed on a linked graph. After the desired range of motion has been graphed, you can use Logger *Pro*'s analysis features to study the plotted data.

Logger *Pro* can analyze any movie that can be played by Quicktime, which includes most movie formats including .avi and .mov. These can be movies that you capture directly from a video input such as a digital video camera or web camera.

---

<sup>1</sup> Instead of marking one object across frames (time) as you would in a movie, analysis of a picture allows you to mark many points on one frame. This is useful in getting the points along a curve, for example.

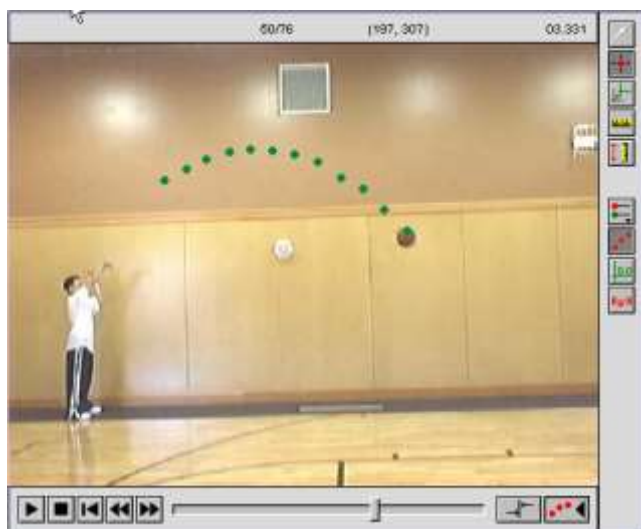


Figure 1

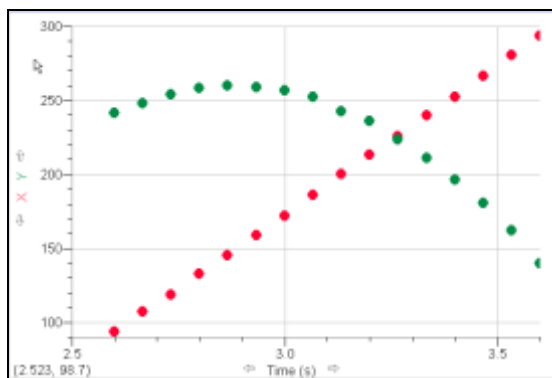



Figure 2

**Movie Buttons:** There are five buttons in the bottom left corner of the movie object (Fig. 1) The button furthest on the left is the Play button. Click it to play the movie. The next button to the right is the Stop button. It will stop the movie during replay. The third button "rewinds" the video to the beginning. The next two buttons move the video to the previous or next frame.

Click  in the bottom right corner of the movie object to open the Video Analysis Toolbar. A new graph will also be displayed, and a new columns are added to the data table.

### Video Analysis Toolbar Buttons

The Video Analysis Toolbar buttons run along the right edge of the video, and provide access to all the video point-manipulation features in *Logger Pro*.



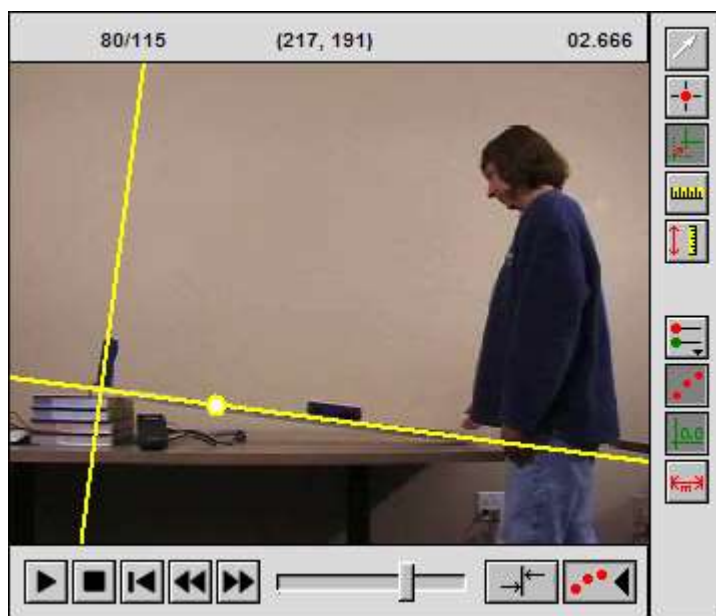
**Select Point:** Selects an existing point on the movie. Select this tool, click on a point, and the point will be selected and the video will jump to the corresponding frame. The marked point can be dragged to change the position of the point, or it can be deleted.



**Add Point:** Enters the point marking mode to track objects through the frames of the video. Once in the Add Point mode, click on the object you are following. *Logger Pro* will draw a point on the location, and then advance the frame of the video.



**Set Origin:** Sets the location of the origin. Once in Set Origin mode, click on the video to set the origin. If desired, drag the yellow dot to rotate the coordinate system. This is helpful, for example, when



studying the motion of a cart rolling up or down an inclined ramp. For experiments like the one in Figure 3 where the x-axis is not horizontal, it is convenient to rotate the coordinate system so that the x-axis is parallel to the ramp.



**Set Scale:** When you add points to the movie, the program initially records the coordinates of each point in screen pixels. This option allows you to convert those coordinates to a physical measurement such as meters. In the example shown above, the meter stick can be used to set the scale. Click the Set Scale button and drag across the length of the meter stick. A dialog will open for you to enter the length of the object you have indicated.



**Set Active Point:** You can follow the motion of multiple objects in the video. After marking the position of one object, rewind the video to the first useful frame. Click the Set Active Point button, and use the popup menu to create a new data series. A new series adds columns to the data table, and points marked on the video will be added to the new series. You can also choose to return to a previous series using this tool.



**Toggle Trail:** Displays or hides all the points that have been added up to the current time. For example, if you have a total of 10 points, one point per second, and you toggle at 5 seconds, you would see the points from 0–5 seconds.



**Show Origin:** Display the origin on the movie object. Click again to remove the origin. The origin is set with the Set Origin button.



**Show Scale:** This will show or hide the line that was used when setting the scale (see Set Scale).

A tutorial covering video analysis is available. Select Open from the File menu, and then open Tutorial 12–Video Analysis in the Tutorials folder.


For a sample photo or image analysis project, open the file Sample Data\Mathematics\Catenary Model\stlouisarch.cmb1. In this file a photo (not a multiple frame video) is analyzed to model the shape of the St. Louis Arch.

---

## Viewing videos synchronized with sensor data

Logger Pro includes a number of sample videos. Choose Open from the File menu, and navigate to the Sample Movies folder. As an example, open the Ball Toss folder and open the file called Ball Toss. Here are some things to try with this file:

- Click the Start button in the Replay control to both play the video and display the Motion Detector data.
- After the replay ends, change the replay speed to 0.5, and click start again. Is it easier to see what is happening?

- Click the Examine button  and move the mouse over the velocity graph. Use this tool to determine where the ball is when the velocity graph crosses through zero. Note that the video frame displayed corresponds to the cursor location when in Examine mode.

---


## Synchronizing videos with sensor data

The videos described in the previous section have already been synchronized with the sensor data. This section describes how to insert and then synchronize an existing video to some sensor data.

If it is not already open, open the Ball Toss file in Sample Movies/Ball Toss. Click the start button on the Replay control to play the video and expose the data. After replay completes, click once on the video and delete it using the Delete key on the keyboard. Now you have some motion detector data with no video, and you can practice the process of inserting an existing video and then syncing it to the data.

1. Insert the video by choosing Movie from the Insert menu. Since you recently opened the Ball Toss file, the open file dialog should still be pointing to the Ball Toss folder (if not, navigate there). Select the Ball Toss.mov file (that's the video file) and click Open. If you like, choose Auto Arrange from the Page menu to clean up the layout.
2. Click the Start button on the Replay control. Note that the video and data are no longer synced; you're about to fix that.

To synchronize a movie with data you need to identify a common moment in time in both the data and movie. Sometimes you can use the physics of the motion, but in other cases you may have an event such as a finger tapping a force sensor before an experiment actually starts to find the common time. In this case we'll use the physics of the event. The ball is farthest from the motion detector when the ball is at the maximum height; the position graph shows a maximum value. Those are the moments in time we want to synchronize.

3. Click the Sync button  on the video object. This opens a dialog, which you may want to drag out of the way. You'll need to be able to see both the position graph and the video.
4. Click on the graph at the maximum position value. This places a dot on the graph, and enters the corresponding time from the data into the sync dialog box.
5. Use the play, forward and backward controls on video to move to the frame where the ball is at its maximum height.
6. Click OK in the Movie Synchronization dialog to commit to the synchronization.
7. Click Start in the Replay tool, and note that your video is now synchronized to the data.

A tutorial covering video synchronization is available. Select Open from the File menu, and then open Tutorial 11-1 Working with Movies in the Tutorials folder.

## Video Capture

Logger *Pro* can capture video directly from a video input such as a digital video camera or web camera. The video might be captured on its own, or it might be captured while sensor data are also being collected. Time lapse videos are available, with or without sensor data.

### Recommended Cameras

1. a consumer DV camera with firewire or USB 2 output
2. Logitech QuickCam Pro 5000 (Windows only)
3. Apple iSight
4. Proscope

If your intended video analysis use is in physics, with objects in freefall motion, you will almost certainly want the higher quality provided by a DV camera. Webcams, the iSight and the Proscope work well for slower events, time lapse, and for documenting experiments with still images. Video capture may work with other USB or firewire cameras; however Logger *Pro* has not been tested with them.

Many digital still cameras can collect short video clips that are ideal for use with Logger *Pro*. However, since these cameras are not designed to be controlled by a computer, they cannot capture video under the control of Logger *Pro*. Instead, the video must be collected using the camera's controls and transferred from the camera as a file. Then the processes above of using an existing video file can be used.

The following steps for video captures assume that any software that comes with the camera has already been installed on the computer. If the camera doesn't work with the manufacturer's software, it cannot work with Logger *Pro*.

### Video Capture Only

1. Connect the camera to the computer.
2. Start Logger *Pro*.
3. Choose Video Capture from the Insert menu. If a camera is detected, the Video Capture dialog box will appear, and it will display an active video feed from the camera. If you do not see the live video feed, click the set up camera button and configure your camera.
4. The Video Capture dialog box will show live video. Click the Options button in the Video Capture dialog box to choose the Video Capture Only mode. Set your desired capture duration. Note: Long captures that are not time-lapse will create very large files.
5. To capture video, click the Start Capture button. You can let the capture run for the allotted time or click the Stop Capture button.
6. At the end of the capture, a movie object for the capture will appear on the Logger *Pro* main window. If you capture additional videos, they will also appear on the Logger *Pro* main window.
7. To save the movie or movies, choose Save from the File menu. Choose the appropriate folder and give your Logger *Pro* file a name. The movie(s) will be saved in the same

directory as your *Logger Pro*. By default the video files will be named sequentially, MovieCapture1, MovieCapture2, etc.

### **Video Capture While Simultaneously Collecting Data**

1. Set up some sensor for data collection.
2. Choose Video Capture from the Insert menu. Click the Options button to open the Video Capture Options dialog.
2. Choose the Video Capture Synchronized with Sensor Data Collection option.
3. If data collection will run more than 10–15 seconds, you may want to capture a time-lapse movie to avoid creating a very large video file. To enable this mode, click the Time Lapse Mode option, and choose how often an image should be collected.
4. Click .
5. When you click the Start Capture or Start Time Lapse button, video capture and data collection will start. Don't use the standard Collect button, for it will not start the video capture.
6. At the end of the capture, a movie object for the capture will appear on the *Logger Pro* main window.
8. To save the movie or movies with your data, choose Save from the File menu. Choose the appropriate folder and give your *Logger Pro* file a name. The movie(s) will be saved in the same directory as your *Logger Pro*. By default the video files will be named sequentially, MovieCapture1, MovieCapture2, etc.

### **Take Photo**

You can use your video camera to take a snapshot, treated as a picture in JPEG format, by clicking the Take Photo button. This feature is useful for documenting experimental setups.